16	0	6633186.pn. and ((((345/107 or 349/89 or 359/296 or 204/450 or 204/600 or 427/213.3 or 427/212 or 264/1.36 or 264/1.7 or 264/4.1 or 264/437-438).ccls.) and particl$3 WITH "no" NEAR2 (power or voltage or electric$3 NEAR2 field$1)) or (((345/107 or 349/89 or 359/296 or 204/450 or 204/600 or 427/213.3 or 427/212 or 264/1.36 or 264/1.7 or 264/4.1 or 264/437-438).ccls.) and particl$3 WITH "off" NEAR2 (power or voltage or electric$3 NEAR2 field$1)) or (((345/107 or 349/89 or 359/296 or 204/450 or 204/600 or 427/213.3 or 427/212 or 264/1.36 or 264/1.7 or 264/4.1 or 264/437-438).ccls.) and particl$3 WITH "zero" NEAR2 (power or voltage or electric$3 NEAR2 field$1)))	USPAT	2004/03/20 20:05
17	1	6636186.pn.	USPAT	2004/03/20 20:05
18	1	6636186.pn. and ((((345/107 or 349/89 or 359/296 or 204/450 or 204/600 or 427/213.3 or 427/212 or 264/1.36 or 264/1.7 or 264/4.1 or 264/437-438).ccls.) and particl$3 WITH "no" NEAR2 (power or voltage or electric$3 NEAR2 field$1)) or (((345/107 or 349/89 or 359/296 or 204/450 or 204/600 or 427/213.3 or 427/212 or 264/1.36 or 264/1.7 or 264/4.1 or 264/437-438).ccls.) and particl$3 WITH "off" NEAR2 (power or voltage or electric$3 NEAR2 field$1)) or (((345/107 or 349/89 or 359/296 or 204/450 or 204/600 or 427/213.3 or 427/212 or 264/1.36 or 264/1.7 or 264/4.1 or 264/437-438).ccls.) and particl$3 WITH "zero" NEAR2 (power or voltage or electric$3 NEAR2 field$1)))	USPAT	2004/03/20 20:05

oil, alkyl-modified silicone oil, α-methylsulfone-modified silicone oil, chlorophenylsilicone oil, fluorine-modified silicone oil and amino-modified silicone oil. Examples of the white particles **20** include the spherical fine particles (MBX-White made by Sekisui Chemical Co., Ltd.) of titanium oxide-containing crosslinked polymethyl methacrylate, spherical fine particles (Chemisnow-MX made by Soken Chemical Co., Ltd.) of crosslinked polymethyl methacrylate containing a titanium oxide pigment fine powder, a product obtained by striking a white pigment fine powder into the spherical fine particles with an impulse force to fix the same in the surfaces of the fine particles, and particles obtained by adhering or embedding a white pigment fine powder to or in surfaces of mother particles made of various materials such as a styrene resin, a phenolic resin, a silicone resin and a glass. The spherical fine particles (Chemisnow-MX made by Soken Chemical Co., Ltd.) of crosslinked polymethyl methacrylate are monodisperse and have a uniform particle diameter. The charging properties of particles are uniform, the threshold value in the particle movement to the electric field is sharper, and a high contrast is obtained. Examples of the white pigment include titanium oxide, magnesium oxide and zinc oxide. Examples of the white particles include porous sponge particles and hollow particles including air therein. Further, a toner used in a copier or a printer, especially spherical particles formed by a wet method such as a polymerization method or a suspension method are also available.

Examples of the black particles **18** include the spherical fine particles (MBX-Black made by Sekisui Chemical Co., Ltd.) of crosslinked polymethyl methacrylate, spherical particles (Micropearl BB and Micropearl BBP made by Sekisui Chemical Co. Ltd.) formed of a crosslinked copolymer containing divinylbenzene as a main component, amorphous carbon fine particles prepared by calcining phenol resin particles (Univeks GCP made by Unitika Ltd.) and carbon and graphite spherical fine particles (Nika-Bead ICB, Nika-Bead MC and Nika-Bead PC made by Nippon Carbon K.K.). Further, besides the black and white particles, color particles such as red, blue, green, magenta, cyan, yellow, gold and silver particles are also available. Examples thereof include spherical fine particles (MBX-Red made by Sekisui Chemical Co., Ltd.) of crosslinked polymethyl methacrylate, and spherical conductive particles (Micropearl AU made by Sekisui Chemical Co. Ltd.) obtained by applying electroless nickel plating and then gold substitution plating to surfaces of fine particles formed of a crosslinked copolymer containing divinylbenzene as a main component. Still further, a toner used in a copier or a printer, especially spherical particles formed by a wet method such as a polymerization method or a suspension method are also available.

For example, magenta spherical particles are prepared as follows. One hundred parts by weight of a polyester resin, 4 parts by weight of C. I. Pigment Red 57 and 110 parts by weight of ethyl acetate are dispersed with a ball mill for 48 hours to form solution A. Meanwhile, 100 parts by weight of a carboxymethylcellulose 2% aqueous solution is prepared as solution B. Subsequently, 100 parts by weight of solution B is stirred with an emulsifier, and 50 parts by weight of solution A is slowly charged therein to form a suspension. Then, ethyl acetate is removed under reduced pressure, and the residue is washed with water, dried, and classified to obtain magenta particles. The average particle diameter of the particles is 7 μm. The red particles and the white particles are mixed at a weight ratio of 1:5, and contained between the substrates. An electric field is applied to provide display with a contrast of red and white.

In this manner, the particle groups excellent in charging properties, fluidity and environmental stability are obtained. The electric field is applied between the substrates with the particle groups contained to move the particle groups, whereby the high black density and the high white density are obtained and the display with the high contrast can be provided.

EXAMPLE 1

An example of the first embodiment is described.

With respect to the image display medium **10** of the first embodiment, the dependence of the moving properties of the white particles **20** and the black particles **18** between the substrates on the filling amount and the filling rate was tested, and the results shown in Table 1 were obtained. The average particle diameter of the black particles **18** was 20 μm, and the average particle diameter of the white particles **20** was 20 μm. The mixing ratio of the black particles **18** and the white particles **20** was 1:2 (weight ratio). At this time, the true specific gravity of the black particles **18** was 1.23, and the true specific gravity of the white particles **20** was 1.85. Further, the filling rate was indicated in terms of (total volume of particles/volume of gap between substrates).

TABLE 1

	Gap between substrates (mm)	Filling rate (vol. %)	Filling amount (mg/cm²)	Black density	White density
Ex. 1	0.3	52	24.9	Particles are not moved.	Particles are not moved.
Ex. 2	0.3	42	20.1	Part of particles are moved.	Part of particles are moved.
Ex. 3	0.3	22	10.5	1.5–1.6	0.35–0.4
Ex. 4	0.3	16	7.7	1.5–1.6	0.35–0.4
Ex. 5	0.3	14	6.7	1.5–1.6	0.35–0.4
Ex. 6	0.3	8	3.8	1.5–1.6	0.35–0.4
Ex. 7	0.3	6	2.9	1.2–1.3	0.4–0.5
Ex. 8	0.1	42	6.7	Part of particles are moved.	Part of particles are moved.
Ex. 9	0.1	24	3.8	1.4–1.5	0.45–0.55